

Technical Tips & Lessons Learned to Make In-Situ Bypasses More Effective and Effective

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No Disclosures

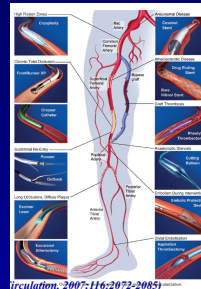
- Thanks to my partners past and present who pioneered this procedure:
 Alistair Karmody, Bob Leather, Ben Chang,

Historical Aspects of *In-situ* Bypass

- In 1958, Charles Rob did first with Karl Victor Hall as visiting fellow
- Robert Leather learned from Karl Victor Hall
- Valve excision, blunt valve disruption and then valvulotomes used

Reasons to use In-Situ Technique?

Challenges of CLI



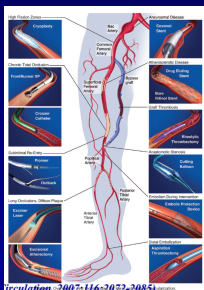
Benefits of in-situ

- Obviates Size Mismatch
- Better for Smaller Veins
- Less Warm Ischemia
- Potential Endothelial Preservation
- Less Thrombogenic
- **Concerns re in-situ**
- New/Difficult Technique
- Potential Risks with Valvulotomy
- Time and Learning Curve

TREAT THE VEIN LIKE AN ORGAN TRANSPLANT

What Do We Know About Distal Bypass Surgery?

Challenges of CLI



Relatively Unimportant Factors

- DIABETES
- DISTAL ARTERIAL CALCIFICATION
- OUTFLOW RESISTANCE
- BYPASS LENGTH

Relatively Important Factors

- VEIN QUALITY
- VEIN PRESERVATION
- MINIMIZE VEIN TRAUMA
- **TREAT THE VEIN LIKE AN ORGAN TRANSPLANT**

Journal of Vascular Surgery
 Volume 1, Issue 6, November 1984, Pages 912-913
 ELSEVIER

Symposium on Femoral-Tibial Bypass
 In situ saphenous vein arterial bypass to the tibial arteries *

Robert P. Leather M.D.
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[https://doi.org/10.1016/0741-5214\(84\)90025-9](https://doi.org/10.1016/0741-5214(84)90025-9) Get rights

Resurrection of the *In Situ* Saphenous Vein Bypass
 1000 Cases Later

ANNALS OF SURGERY
 Vol. 222, No. 4, 439-448
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ROBERT P. LEATHER, M.D., DHIRAJ M. SHAH, M.D., BENJAMIN B. CHANG, M.D., and JEFFREY L. KAUFMAN, M.D.

LEATHER AND OTHERS
 Ann. Surg. - October 1993

Long-Term Results of *In Situ* Saphenous Vein Bypass
 Analysis of 2058 Cases

Dhiraj M. Shah, M.D., R. Clement Darling II, M.D., Benjamin B. Chang, M.D., Kathleen M. Fitzgerald, B.S., Philip S. K. Paly, M.D., and Robert P. Leather, M.D.
 From Albany Medical College, Vascular Surgery Section, Albany, New York

Because of the poor preliminary patency of reversed vein grafts ≤ 3.0 mm in minimum distended diameter, we suggest the in situ method be used preferentially when such small veins are encountered.



Important Factors for a Successful In-Situ Bypass

- Knowledge GSV anatomy/Preop Vein Map
- Minimize Skin Flaps
- Vein Preparation/ Graded pressure
- Open or closed In-situ
- Specialized In-situ equipment helpful
- Sharp Mills and retrograde valvulotomes
- Duplex or Knowledge of “null” method
- Double Team reduces Operative Time

Saphenous Vein Anatomy (338 Venograms) *

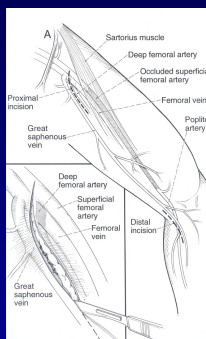
- Greater Saphenous Vein (Single 38%/ Double 10%)
 - Thigh
 - Single 65% (Medial 60%, Lateral 5%)
 - Double 11%
 - Loop 15%
 - Calf
 - Single 45% (Anterior 41%, Posterior 4%)
 - Double 46%
- Valves: 6.3 ± 2.8 / leg, 3 in thigh segment

* JVS 1986; 3:273-83

Vein Mapping (Duplex)



Incision Location

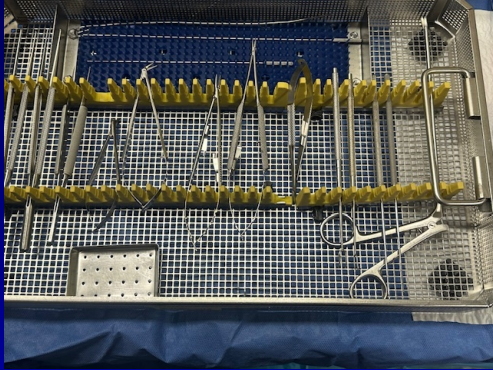


- Thigh
 - Medial (InSitu Bypass)
 - Lateral (Excised, Prosthetic)
- Calf
 - 1 cm ant/post to vein
 - Medial exposure of peroneal artery
- Skin bridges
 - Maximize width from GSV exposure to distal AT/PT,DP

Incision Location

- Proximal
 - Sharp Dissection/ Minimize Bovie around Vein
 - Identify Vein First
 - Avoid Lymph Nodes: Medial vs Lateral Exposure
 - Avoid Flaps
- Distal
 - Standard arterial exposures
 - Incision to Expose Vein 1 cm posterior
 - Avoid Flaps

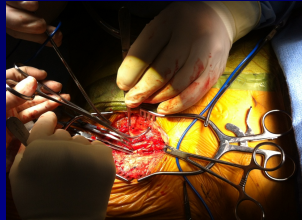
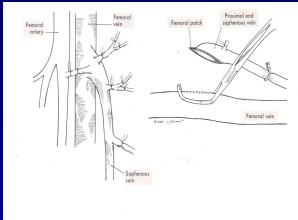
“In-Situ” Set



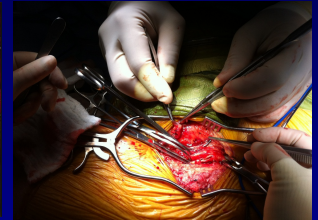
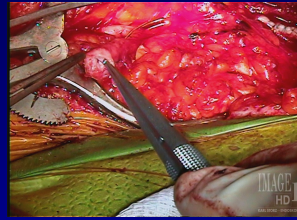
Vein Preparation

- **In situ** vs Excised Vein
- Orientation of Vein: Reversed versus Orthograde (based on taper)
- Knowledge of Vein Anatomy
- Preoperative Mapping/Venography: Vein Quality
- Direct Assessment of Vein Quality: Distensibility / Appearance
- Atraumatic Technique

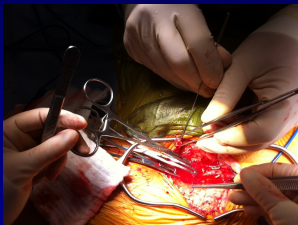
Proximal Valve Lysis



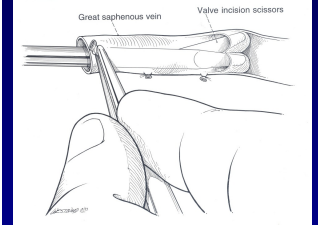
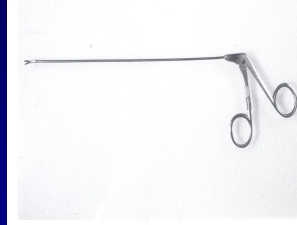
Proximal Valve Lysis



Proximal Valve Lysis: Antegrade Valvulotome



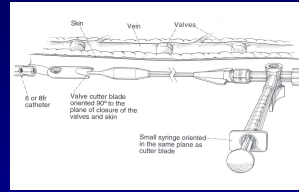
Proximal Valve Lysis



InSitu Bypass Technique: Thigh Valve Lysis

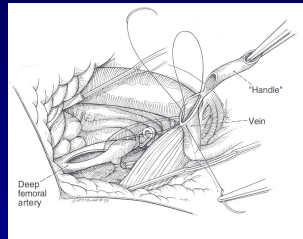
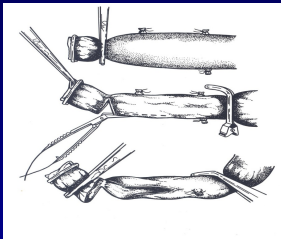
- Thigh
 - Proximal Valves: Direct Lysis/Antegrade Valvulotome
 - Leather Cutter: (>3mm) Expense/Availability
 - Lemaitre: (>4.5mm)
 - Small or Complicated Vein Use Retrograde (Modified Mills) Valvulotome *
 - Calf-Foot
 - Retrograde Valvulotome
- * Always Safest Method

InSitu Bypass Technique: Valve Lysis: Leather Cutter

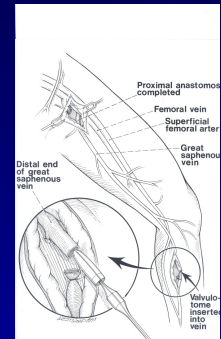
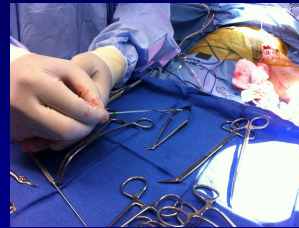


- Lysis before Proximal Anastomosis done
- Side Branch Access (@ knee)
- Requires Proximal Vein Distention
- Pressure Solution of Heparin 1000U, Papaverine (120mg) in 500 cc Dextran70 (300 mmHg)
- Avoid manual distention

Proximal Anastomosis



InSitu Bypass Technique: Lemaitre Valvulotome



JVS Journal of Vascular Surgery SVS Society for Vascular Surgery

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ABSTRACT ONLY Volume 48, Issue 4, Epub-Epub, October 2012 Open Archive

In-Situ Bypass, Open or Closed, is a Durable Technique for Limb Preservation Trends and Outcomes Over the Last 30 Years

Tigran Davtyan Jeffrey Heath Amanda Kissler Melissa Shah Benjamin Cheng B. Clement Darling Show more

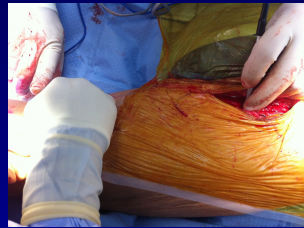
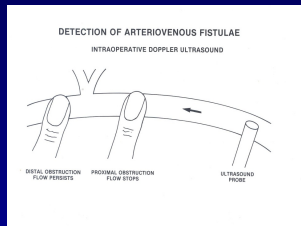
Affiliations & Notes Article Info

There were 6191 ISBs (3255 [53%] oISBs and 2936 [47%] cISBs). The below-knee popliteal artery was the most common outflow vessel in both oISB and cISB (37.3% vs 33.9%; $P = .02$). oISB had higher rates of dorsalis pedis, plantar, and below-knee popliteal outflow compared with cISB ($P < .05$), whereas cISB had higher rates of peroneal, above knee popliteal, and anterior tibial outflow ($P < .05$). Operative mortality was higher in oISB (39 [1.2%] vs 13 [0.44%]; $P = .001$). Major amputation was similar for oISB and cISB (288 [8.85%] vs 219 [7.46%]; $P = .27$).

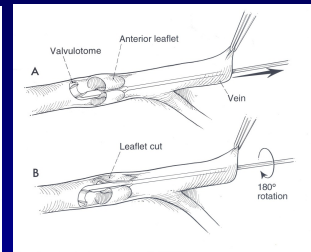
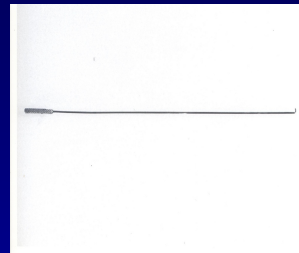
Thrombosed Fistula



Check For Fistula in Thigh (Null Technique)

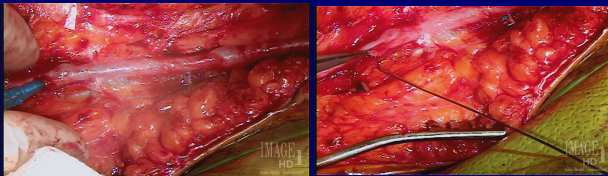


Retrograde Valvulotome (Modified Mills)

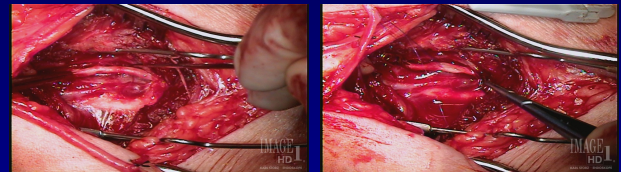


Retrograde Valve Lysis

Incise Valve not Cusp
Watch For Side Branches
Flat Side Anterior on Mills
Dilate Before Manipulation
Flow Should Be Linear at Completion



Distal Anastomosis



Assessment of Bypass Flow

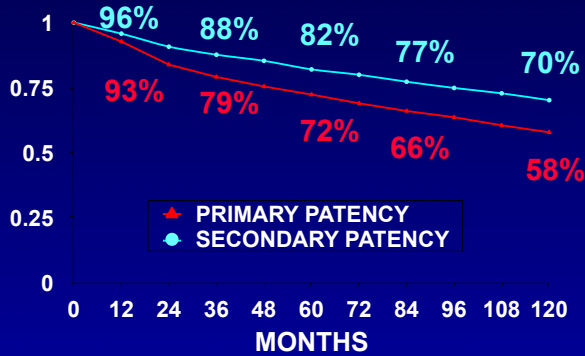
- Intraoperative Doppler
- Intraoperative Duplex
- Intraoperative Angiography/Pressure Measurement
- Postoperative PVR/Duplex/Angiogram

OUR DATA

Total procedures: 19,391 from 1976-2024

In situ	8415	45.2%
Excised vein	5,407	30.1%
Spliced vein	1,697	7.6%
Prosthetic	3,872	19.4%
Op mortality	381	1.8%

IN SITU BYPASS PATENCY



Complications

Bleeding	2.8%
Wound infection	5.4%
Bypass infection	0.6%
Hemodynamic failure	2.1%
Occlusion, immediate	3.7%
Occlusion, late	5.5%
Limb loss, immediate	2.3%
Limb loss, late	3.0%

Key Steps in The In-Situ Bypass

- Knowledge of GSV Anatomy
- Pre-op Vein Map to Minimize Flaps
- Direct assessment of vein Quality Intra Op
- Graded Dilatation of vein (<300 mm hg)
- Dilate Vein before any Manipulation
- Access for “ Closed Cutter” at Knee
- Specialized “in-situ set” Instrumentation

CONCLUSION

In-Situ Bypass is a durable procedure for limb salvage
Closed in-situ bypasses have less wound complications
but comparable patency and limb salvage to open in-situ
bypass

Questions
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Thank You!